
खाद्य, पेय, डेयरी और दवा उद्योग के लिए
स्टेनलेस इस्पात नलिकाएँ — विशिष्टि
(पहला पुनरीक्षण)

**Stainless Steel Tubes for the Food,
Beverage, Dairy and Pharmaceutical
Industry — Specification**
(First Revision)

ICS 77.140.20

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FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Steel Tubes, Pipes and Fittings Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1973. This revision has been brought out to bring the standard in the latest style and format of the Indian Standard. In addition, following significant modifications have been made:

- a) The title of the standard has been modified. 'Dairy and Pharmaceutical Industry' is also included in the title of the standard;
- b) The scope of the standard has been revised;
- c) Clause **5** on manufacture has been modified;
- d) Clause **6** on ordering information has been added;
- e) New sizes have been included in **9**;
- f) Clause **12** on finish has been modified;
- g) Clause **13** has been modified to include tensile and hardness requirements of new grades added; and
- h) Clause **14**, reverse flattening test, **15**, hydrostatic test, **16**, optional/supplementary tests have been added.

This standard has been prepared to assist the users and manufacturers of stainless steel tubes for use in the food, beverage, dairy and pharmaceutical industry.

The composition of the Committee responsible for formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

STAINLESS STEEL TUBES FOR THE FOOD, BEVERAGE, DAIRY AND PHARMACEUTICAL INDUSTRY — SPECIFICATION

*(First Revision)***1 SCOPE**

This standard covers the requirements for seamless, welded and heavily cold worked welded stainless-steel tubes of outside diameter less than or equal to 304.8 mm, for the food, beverage, dairy and pharmaceutical industry, requiring special surface finish.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

3 TERMINOLOGY

For the purpose of this standard the terms and definitions provided in relevant parts of IS 1956 shall apply.

4 SUPPLY OF MATERIAL

General requirements relating to the supply of the steel tubes shall conform to IS 1387.

5 MANUFACTURE

5.1 The tubes shall be made by seamless, welded or heavily cold worked welded process. Heavily cold worked welded tubes shall be made by applying 35 percent or more cold working on the wall including weld joint to a welded tube before the final anneal.

In case of welded and heavily cold worked welded tubes, no filler material shall be used during the welding process. To produce heavily cold worked tubes, weld shall be 100 percent inspected by radiography prior to cold working and a minimum of 35 percent of reduction in thickness of both wall and weld shall be done to the welded tubes prior to the final annealing.

5.2 Seamless tubes may be supplied either hot-finished or cold-finished.

5.3 It is recommended that the manufacturing and storage of finished tubes should be done in dust free environment, so as to avoid rust marks.

6 ORDERING INFORMATION

The purchaser should clearly specify the requirement while ordering and may include, but not limited to the followings in the order:

- a) Quantity (meters or number of lengths);
- b) Process [seamless (SML), welded (WLD), or heavily cold worked welded (HCW)];
- c) Size (outside diameter and wall thickness);
- d) Length (specific or random);
- e) Surface finish; and
- f) Any supplementary/optional requirements.

7 HEAT TREATMENT

All tubes shall be supplied in the heat-treated condition. The heat treatment shall be done as specified in Table 1.

8 CHEMICAL COMPOSITION**8.1 Ladle Analysis**

The ladle analysis of stainless steel tubes shall conform to the one of the grades mentioned in Table 2. The analysis of steel shall be carried out either by the method specified in IS 228 (relevant parts) or any other established instrumental/chemical methods.

In case of dispute the procedure given in IS 228 and its relevant parts shall be the referee method. However, where method is not given in IS 228 and its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

8.2 Product Analysis

The permissible variations, in the case of product analysis from the limits specified in the Table 2, shall be as given in Table 3.

9 DIMENSIONS

9.1 The outside diameter and thicknesses of the tubes shall be as given in Table 4.

Table 1 Heat Treatment for Stainless Steel Tubes

(Clause 7)

SI No.	Grade Designation Letter Symbol	Numerical Symbol ISS	Heat Treatment Temp (°C)	Cooling
(1)	(2)	(3)	(4)	(5)
i)	Austenitic steels			
	a) X04Cr19Ni9	304	1 040, <i>Min</i>	Quenched in water or rapidly cooled by other means
	b) X02Cr19Ni10	304L	1 040, <i>Min</i>	Quenched in water or rapidly cooled by other means
	c) X02Cr20Ni18Mo6CuN	312	1 040, <i>Min</i>	Quenched in water or rapidly cooled by other means
	d) X04Cr17Ni12Mo2	316	1 040, <i>Min</i>	Quenched in water or rapidly cooled by other means
	e) X02Cr17Ni12Mo2	316L	1 040, <i>Min</i>	Quenched in water or rapidly cooled by other means
	f) X01Cr20Ni25Mo6Cu	904LN	1 100, <i>Min</i>	Quenched in water or rapidly cooled by other means
ii)	Duplex steels			
	a) X02Cr22Ni5Mo3N	1803	1 020 to 1 100	Rapid cooling in air or water
	b) X02Cr22Ni6Mo3N	2205	1 020 to 1 100	Rapid cooling in air or water
	c) X02Cr25Ni7Mo4CuN	2507	1 025 to 1 125	Rapid cooling in air or water

Table 2 Chemical Composition, Percent

(Clauses 8.1 and 8.2)

SI No.	Grade Designation Letter Symbol [see IS 1762 (Part 1)]	Numerical Symbol ISS	C <i>Max</i>	Si <i>Max</i>	Mn <i>Max</i>	Ni	Cr	Mo	S <i>Max</i>	P <i>Max</i>	N <i>Max</i>	Cu <i>Max</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	Austenitic steels											
	a) X04Cr19Ni9	304	0.070	0.75	2.00	8.0 to 10.5	17.5 to 19.5	—	0.030	0.045	0.10	—
	b) X02Cr19Ni10	304 L	0.030	0.75	2.00	8.0 to 12.0	17.5 to 19.5	—	0.030	0.045	0.10	—
	c) X02Cr20Ni18Mo6CuN	312	0.020	0.80	1.00	17.5 to 18.5	19.5 to 20.5	6.0 to 6.5	0.010	0.030	0.18 to 0.25	0.50 to 1.00
	d) X04Cr17Ni12Mo2	316	0.080	0.75	2.00	10.0 to 14.0	16.0 to 18.0	2.0 to 3.0	0.030	0.045	0.10	—
	e) X02Cr17Ni12Mo2	316 L	0.030	0.75	2.00	10.0 to 14.0	16.0 to 18.0	2.0 to 3.0	0.030	0.045	0.10	—
	f) X01Cr20Ni25Mo6Cu	904LN	0.020	0.50	2.00	24.0 to 26.0	19.0 to 21.0	6.0 to 7.0	0.010	0.030	0.15 to 0.25	0.50 to 1.50

Table 2 (Concluded)

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Sl No.	Grade Designation Letter Symbol [see IS 1762 (Part 1)]	Numerical Symbol ISS	C Max	Si Max	Mn Max	Ni	Cr	Mo	S Max	P Max	N Max	Cu Max
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
ii)	Duplex											
	a) X02Cr22Ni5Mo3N	1 803	0.030	1.00	2.00	4.5 to 6.5	21.0 to 23.0	2.5 to 3.5	0.020	0.030	0.08 to 0.20	—
	b) X02Cr22Ni6Mo3N	2 205	0.030	1.00	2.00	4.5 to 6.5	22.0 to 23.0	3.0 to 3.5	0.020	0.030	0.14 to 0.20	—
	c) X02Cr25Ni7Mo4CuN	2 507	0.030	0.80	1.20	6.0 to 8.0	24.0 to 26.0	3.0 to 5.0	0.020	0.035	0.24 to 0.32	0.50
NOTE — For pharmaceutical application sulphur shall be between 0.005 percent and 0.017 percent for grades 316 and 316 L.												

Table 3 Permissible Variation between Specified Analysis and Product Analysis

(Clause 8.2)

SI No.	Element	Limits of Ladle Analysis as Shown in Table 1,		Permissible Deviation ¹⁾
		Percent		Percent
		Over	Up to and including	± unless specified as +
(1)	(2)	(3)	(4)	(5)
i)	C	—	0.03	+ 0.005
		0.03	0.2	0.01
ii)	Si	—	1	0.05
iii)	Mn	—	1	0.03
		1	3	0.04
iv)	Cr	10	15	+ 0.15
		15	20	0.20
		20	30	0.25
v)	Mo	—	0.6	+ 0.03
		0.6	1.75	0.05
		1.75	3	0.10
vi)	Ni	—	1	+ 0.03
		1	5	0.07
		5	10	0.10
		10	20	0.15
		20	30	0.20
vii)	N	—	0.02	0.005
		0.02	0.15	0.01
		0.15	0.35	0.02
viii)	S	—	0.04	+ 0.005
ix)	P	—	0.04	+ 0.005
		0.04	0.1	0.01
x)	Cu	0.5	1	0.05
		1	3	0.10
NOTE — Tolerance shall be mutually agreed to between the purchaser and supplier for the range of elements beyond the scope mentioned in above table.				

¹⁾ The use of '+' means that in one cast the deviation may occur over the upper value or under the lower value of the specified range in the table but not both at the same time.

Table 4 Dimensions

(Clause 9.1)

All dimensions in millimetres.

SI No.	Outside Diameter	Thickness	
		Welded/heavily cold worked	Seamless
(1)	(2)	(3)	(4)
i)	6	—	0.7, 0.9
ii)	8	—	1.0, 1.2
iii)	12.7	1.0, 1.2, 1.6	1.0, 1.2, 1.6
iv)	15.9	1.0, 1.2, 1.6, 2.0	1.0, 1.2, 1.6
v)	19.05	1.0, 1.2, 1.6, 2.0	1.2, 1.6, 2.0,
vi)	25.4	1.0, 1.2, 1.6, 2.0, 2.3	1.6, 2.0, 2.3, 2.6, 3.0, 3.2, 3.6
vii)	31.8	1.2, 1.6, 2.0, 2.3	1.6, 2.0, 2.3, 2.6, 3.0, 3.2, 3.6
viii)	38.1	1.2, 1.6, 2.0, 2.3	1.6, 2.0, 2.3, 2.6, 3.0, 3.2, 3.6
ix)	42.4	1.2, 1.6, 2.0, 2.3	1.6, 2.0, 2.3, 2.6, 3.0, 3.2, 3.6
x)	44.5	1.2, 1.6, 2.0, 2.3	1.6, 2.0, 2.3, 2.6, 3.0, 3.2, 3.6
xi)	50.8	1.2, 1.6, 2.0, 2.3, 2.6	1.6, 2.0, 2.3, 2.6, 3.0, 3.2, 3.6
xii)	57	1.2, 1.6, 2.0, 2.3, 2.6	1.6, 2.0, 2.3, 2.6, 3.0, 3.2, 3.6, 4.0
xiii)	63.5	1.6, 2.0, 2.3, 2.6	1.6, 2.0, 2.3, 2.6, 3.0, 3.2, 3.6, 4.0
xiv)	70	1.6, 2.0, 2.3, 2.6, 3.0	2.0, 2.3, 2.6, 3.0, 3.2, 3.6, 4.0
xv)	76.2	1.6, 2.0, 2.3, 2.6, 3.0, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 3.6, 4.0
xvi)	88.9	2.0, 2.3, 2.6, 3.0, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 3.6, 4.0, 5.5
xvii)	101.6	2.0, 2.3, 2.6, 3.0, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 3.6, 4.0, 5.75
xviii)	114.3	2.0, 2.3, 2.6, 3.0, 4.0	2.0, 2.3, 2.6, 3.0, 4.0, 4.5
xix)	127	2.0, 2.3, 2.6, 3.0, 4.0	2.0, 2.3, 2.6, 3.0, 4.0, 4.5
xx)	133	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxi)	139.7	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxii)	152.4	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxiii)	168.3	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxiv)	193.7	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxv)	203.2	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxvi)	219.1	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxvii)	228.6	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxviii)	254.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxix)	279.4	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5
xxx)	304.8	2.0, 2.3, 2.6, 3.0, 3.2, 4.0	2.0, 2.3, 2.6, 3.0, 3.2, 4.0, 4.5

NOTE — Other sizes not included in the table may be supplied as per the agreement between the manufacturer and the supplier, however the agreed outside diameter shall be between 6 mm and 304.8 mm and the agreed thickness not less than the minimum thickness specified against each diameter mentioned in the table. In case diameter is other than the specified diameter, the thickness of the pipe shall not be less than the minimum thickness of next higher size of preferred diameter.

10 TOLERANCES

10.1 Outside Diameter

The purchaser should specify one of the two sets of requirements for the outer diameter. Two sets of tolerances on the outside diameter have been specified as follows:

- a) ± 0.50 percent with a minimum ± 0.10 mm; and
- b) ± 0.75 percent with a minimum of ± 0.30 mm.

10.2 Wall Thickness

The tolerance on the wall thickness shall be ± 12.5 percent.

11 FINISH

11.1 Finished tubes shall be reasonably straight and have smooth ends free from burrs. They shall be free from injurious defects and shall have a work-manlike finish.

11.2 For tubes polished on the inside surface only, the outside surface may have minor defects removed by grinding, provided the wall thickness are not decreased to less than that specified in 7.2.

11.3 Critical Surface Finish

The surface finish shall be measured in accordance with IS 3073/IS 15262. For critical surfaces (in contact with food or beverage) R_a shall be $\leq 1.0 \mu\text{m}$. For other surfaces R_a shall be $\leq 2.5 \mu\text{m}$.

NOTES

- 1 The roughness of the welded bead should not exceed $16 \mu\text{m}$.
- 2 For tubes of diameter below 38 mm or thickness below 0.65 mm, the surface finish requirements may be as agreed between purchaser and the manufacturer.

11.4 Types of Surface Finishes

11.4.1 Mill Finish

A finish without additional polishing or operations intended to smooth the surface.

11.4.2 Mechanically Polished Surface Finish

The purchaser may specify one of the following finish numbers for a mechanically polished surface:

11.4.2.1 Finish no. 80

A ground finish produced by polishing a tube with an abrasive media impregnated with No. 80 grit.

11.4.2.2 Finish no. 120

A ground finish produced by polishing a tube with an abrasive media impregnated with No. 120 grit.

11.4.2.3 Finish no. 180

A ground finish produced by polishing a tube with an abrasive media impregnated with No. 180 grit.

11.4.2.4 Finish no. 240

A ground finish produced by polishing a tube with an abrasive media impregnated with No. 240 grit.

11.4.2.5 Other mechanically polished finishes may be agreed upon between the purchaser and manufacturer.

11.4.3 Electropolished Finish

A bright reflective finish produced by electropolishing. The manufacturer may use other polishing operations prior to electropolishing.

11.4.4 Maximum Roughness Average (R_a) Surface Finish

The customer may specify a maximum R_a on the inside surface, outside surface, or both. The measurement of surface roughness shall be in accordance with IS 3073/IS 15262.

11.4.4.1 When no agreement is made regarding R_a measurement of longitudinally polished tube, disputes shall be resolved using measurements made in accordance with IS 3073/IS 15262.

11.4.4.2 The manufacturer shall select a manufacturing method to produce the specified finish. The operations may or may not include polishing.

The purchaser may specify the polishing type for either the inside surface, outside surface or both for the final desired effect.

11.4.4.2.1 Longitudinally polished finish

It is usually performed on the inside surface only.

11.4.4.2.2 Circumferential (rotary) polished finish

This can be performed on either the inside surface, outside surface, or both.

11.4.4.2.3 When the surface is finished by circumferential mechanical polishing, the R_a measurement shall be measured in the longitudinal direction. Roughness measurement of a longitudinal mechanical polished surface shall be a matter of agreement between the manufacturer and the purchaser.

11.4.5 Acceptance criteria for minor surface imperfections shall be a matter of agreement by the manufacturer and the purchaser.

11.4.6 Combinations of the above finishes for internal and external surfaces may be specified.

When tubes are polished on one surface only, the other surface may be the regular mill finish.

11.4.7 Any other finish as agreed between purchaser and producer may also be supplied and if no finish is specified, it would be left at the discretion of the producer.

12 TENSILE AND HARDNESS TESTS

Two percent of tubes from each batch, with a minimum of two tubes shall be tested for tensile test in accordance with IS 1608 (Part 1) and hardness test in accordance with IS 1586 (Part 1). The material shall conform to the requirements given in Table 5.

13 REVERSE FLATTENING TEST (FOR WELDED TUBES)

One reverse flattening test shall be made on a specimen from each 450 meters of finished tubing.

A section of 100 mm in length of finished welded tubing down to and including 12.7 mm OD shall be split longitudinally 90 degrees and each side of the weld and the sample opened and flattened with the weld at the point of maximum bend. There shall be no cracks or lack of penetration or overlap resulting from flash removal in the weld.

14 HYDROSTATIC TEST

14.1 Each tube shall be tested by the manufacturer by hydrostatic test.

The water for this test should be having chloride content within 30 ppm.

When hydrostatic test is conducted, in case of austenitic steel tubes, the hydrostatic pressure not less than the pressure derived from the following equation shall be used:

$$P = 220.6 \, t/D$$

In case of tube made from duplex steel, the following equation to be used to derive minimum hydrostatic pressure:

$$P = 441.2 \, t/D$$

where

P = hydrostatic test pressure in MPa;

t = wall thickness, in mm; and

D = outside diameter, in mm.

Regardless of the calculation, the maximum hydrostatic pressure shall be 7 MPa unless otherwise

specified by the purchaser.

14.2 The test pressure shall be held for a minimum of 5 s. The test pressure shall be held for a time sufficient to permit the entire length of the tube to be inspected.

14.3 If any tube shows leakage in hydrostatic test, it shall be rejected.

14.4 The hydrostatic test may be substituted by non-destructive electric test if agreed between purchaser and manufacturer. Method of test and acceptance level may be mutually agreed between purchaser and manufacturer.

15 OPTIONAL/SUPPLEMENTARY TESTS

15.1 Intergranular Corrosion Test

Subject to agreement between the purchaser and the supplier, austenitic stainless tubes shall be capable of passing test as per IS 10461 (Part 2). Duplex stainless tubes shall be capable of passing test for detecting detrimental intermetallic phase as per method agreed between purchaser and manufacturer in the as shipped condition.

15.2 Flaring Test (for Seamless Tubes)

Subject to agreement between the purchaser and the supplier, one test shall be carried on specimens from one end of one tube from each lot of finished tubes.

A section of tube about 100 mm in length shall be flared with a tool having a 60° included angle until the tube at the mouth of the flare has been expanded to the extent given in the Table 6, without cracking.

15.3 Flange Test (for Welded Tubes)

Subject to agreement between the purchaser and the supplier, one test shall be carried out in accordance with IS 2330 on specimens from one end of one tube from each lot of finished tubes. For tubes over 203.2 mm in outside diameter, or tubes with wall thickness 9.52 mm and over, the flattening test may be performed instead of the flange test unless the flange test is specified in the purchase order.

A section of tube shall be capable of having a flange turned over at 90 degrees to the body of the tube without cracking. The width of flange shall not be less than the percentage specified in Table 7. For tubes of austenitic grade, the width for all sizes mentioned in table shall be not less than 15 percent.

Table 5 Tensile and Hardness Requirements
(Clause 12)

SI No.	Grade	Tensile Strength, <i>Min</i> MPa	Yield Strength, <i>Min</i> MPa	Percent Elongation (<i>Min</i>) on a Gauge Length of 50 mm	Rockwell Hardness, <i>Max</i>
(1)	(2)	(3)	(4)	(5)	(6)
i)	304	515	205	35	90 HRB
ii)	304L	485	170	35	90 HRB
iii)	316	515	205	35	90 HRB
iv)	316L	485	170	35	90 HRB
v)	1803	620	450	25	30.5 HRC
vi)	2205	655	485	25	30.5 HRC
vii)	2507	800	550	15	32 HRC

Table 6 Extension of the Diameter Required in a Flare Test
(Clause 15.2)

SI No.	Ratio of Inside Diameter to Outside Diameter	Minimum Extension of Inside Diameter in Percent for Austenitic Grades	Minimum Extension of Inside Diameter in Percent for Duplex Grades
(1)	(2)	(3)	(4)
i)	0.9	21	15
ii)	0.8	22	17
iii)	0.7	25	19
iv)	0.6	30	23
v)	0.5	39	28
vi)	0.4	51	38
vii)	0.3	68	50

Table 7 Flange Requirement
(Clause 15.3)

SI No.	Specified OD	Width of Flange
(1)	(2)	(3)
i)	Up to and including 63.4 mm	15 percent of the specified OD
ii)	Over 63.4 mm and up to and including 96.2 mm	12 percent of the specified OD
iii)	Over 96.2 mm and up to and including 203.2 mm	10 percent of the specified OD

15.4 Flattening Test

Subject to agreement between the purchaser and the supplier, flattening tests shall be carried out in accordance with IS 2328 on 5 percent of the tube from heat-treated lot for the tubes of diameter 203 mm and above.

A section of tube not less than 60 mm for seamless tubes and not less than 100 mm in length for welded tubes shall be flattened cold between parallel plates. For the welded tubes and heavily cold worked tubes, the weld shall be placed 90 degrees from the direction of the applied force. During the first step, no cracks or breaks on the inside, outside, or end surfaces shall occur in seamless tubes or in the inside or outside surfaces of welded tubes and heavily cold worked tubes, shall occur before the distance between the plates is less than the value of H calculated as follows:

$$H = \frac{(1 + e)t}{\left(e + \frac{t}{d}\right)}$$

where

H = distance between flattening plates, in mm;

t = specified wall thickness, in m;

D = specified outside diameter, in mm; and

e = deformation per unit length (constant for a given grade of steel, 0.09 for austenitic and duplex steel).

15.5 Chemical Cleaning

Subject to agreement between the purchaser and the supplier, chemical cleaning or passivation of each tube shall be conducted as IS 10117 and IS 13177 after final finishing operation, when specified.

16 RETESTS

Should any one of the test pieces first selected fail to pass any of the tests specified, two further samples shall be selected for testing in respect of each failure from the same lot. Should the test pieces from both these additional samples pass, the material represented by the test samples shall be deemed to comply with the requirement of that particular test. Should the test pieces from either of these

additional samples fail, the material represented by the test samples shall be deemed as not complying with the standard.

17 HYGIENIC CONDITIONS

Proper care should be taken to see that non-ferrous metals and alloys that are joined with stainless steel tubes during fabrication do not leave any harmful deposits affecting either the assembly or the food or beverage, pharmaceutical and dairy application being manufactured.

18 PACKING

In general, at the discretion of the manufacturer, all tubes shall be packed for shipment by bundling, paper or burlap wrapping, or boxing. If any other type of packing is required, it must be specified by the purchaser.

All tubes shall be dry, cleaned and made free from moisture, dirt and loose foreign material of all kinds and protected from rust, corrosion and mechanical damage during transportation and storage.

19 MARKING

19.1 Each pipe shall be marked with the following details:

- a) Name/trade-mark of the manufacturer;
- b) Grade;
- c) Heat number; and
- d) Outside diameter and thickness.

The marking should be legible and permanent. The ink should not be corrosive in nature. Markings should include whether the tube is seamless or welded and its surface finish.

Any other marking pattern can be used for internal traceability as per buyer's confirmation.

19.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

ANNEX A

(Clause 2)

LIST OF REFERRED STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
IS 228 (all parts)	Methods of chemical analysis of steels	IS 3073 : 1967	Assessment of surface roughness
IS 1387 : 1993	General requirements for the supply of metallurgical material (<i>second revision</i>)	IS 10117 : 2000	Code of practice for passivation of stainless steel articles, industrial equipments and components including pipelines (<i>first revision</i>)
IS 1586 (Part 1) : 2018/ISO 6508-1 : 2016	Metallic materials — Rockwell hardness test: Part 1 Test method (<i>fifth revision</i>)	IS 10461 (Part 2) : 1994	Resistance to intergranular corrosion of austenitic stainless steels — Method for determination: Part 2 Corrosion test in a sulphuric acid/copper sulphate medium in the presence of copper turnings (monypenny strauss test) (<i>first revision</i>)
IS 1608 (Part 1) : 2022/ISO 6892-1 : 2019	Metallic materials — Tensile testing: Part 1 Method of test at room temperature (<i>fifth revision</i>)		
IS 1762 (Part 1) : 1974	Code for designation of steels: Part 1 Based on letter symbols (<i>first revision</i>)		
IS 1956 (all parts)	Glossary of terms relating to iron and steel	IS 13177 : 1991	Passivation of stainless steel parts — Specification
IS 2328 : 2018/ISO 8492 : 2013	Metallic materials — Tube — Flattening test (<i>third revision</i>)	IS 15262 : 2002/ISO 4287: 1997	Geometrical product specifications (GPS) — surface texture: profile method — Terms, definitions and surface texture parameters
IS 2330 : 2018/ISO 8494 : 2013	Metallic materials — Tube — Flanging test (<i>third revision</i>)		

ANNEX B*(Foreword)***COMMITTEE COMPOSITION**

Steel Tubes, Pipes and Fittings Sectional Committee, MTD 19

<i>Organization</i>	<i>Representative(s)</i>
Steel Authority of India Limited, New Delhi	SHRI ARUNAVA DASGUPTA (<i>Chairperson</i>)
Bharat Heavy Electrical Limited, New Delhi	SHRI K. ATHIMOOLAM SHRI M. KANNAN (<i>Alternate</i>)
Delhi Jal Board, New Delhi	SHRI PRAVEEN BHARGAVA
Directorate General Quality Assurance, New Delhi	SHRI BIKAS MONDAL SHRI S. K. ROY (<i>Alternate</i>)
Engineers India Limited, New Delhi	RAMESHWAR PRASAD SHRI SANJEEV GUPTA (<i>Alternate</i>)
Federation of Industries of India, Thane	SHRI H. L. BHARDWAJ
GAIL (India) Limited, New Delhi	SHRI M. I. HAQUE SHRI ANURAG SRIVASTAVA (<i>Alternate</i>)
Goodluck Steel Tubes Limited, New Delhi	SHRI M. C. GARG SHRI U. D. SHARMA (<i>Alternate</i>)
Gujarat Gas Company Limited, Ahmedabad	SHRI DHARMESH SAILOR SHRI PRAMATH SHAILESH (<i>Alternate</i>)
Gujarat State Petronet Limited, Gandhinagar	SHRI N. BOSE BABU SHRI NILESH TANNA (<i>Alternate</i>)
Howrah Pipe Fittings Manufacturers Welfare Association, Kolkata	SHRI MAHANANDA DHARA SHRI P. GHOSH (<i>Alternate</i>)
Indian Oil Corporation Limited - Refineries and Pipelines Division, New Delhi	SHRI PARICHAY DAS
Indian Stainless Steel Development Association, Gurugram	SHRI ROHIT KUMAR SHRI NAGENDRA VIJAYVARGIA (<i>Alternate</i>)
Indus Tubes Limited, Pitampura, New Delhi	SHRI I. P. JAIN SHRI D. K. KAPOOR (<i>Alternate</i>)
Jindal Pipes Limited, Hapur	SHRI D. B. SINGH SHRI K. D. SHARMA (<i>Alternate</i>)
Lalita Infraprojects Private Limited, Kolkata	DR BUDDHADEB DUARI SHRI SUBHOJIT BHATTACHARYA (<i>Alternate</i>)
Mazagon Dock Limited, Mumbai	SHRI VINOD KUMAR PARKEWAR SHRI BIJU GEORGE (<i>Alternate</i>)

<i>Organization</i>	<i>Representative(s)</i>
Ministry of Commerce and Industry, Department for Promotion of Industry and Internal Trade, New Delhi	SHRI T. S. G. NARAYANNEN SHRI S. K. JAIN (<i>Alternate</i>)
BITES Limited, Gurugram	SHRI RAMENDRA KUMAR SHRI AJAY SHARMA (<i>Alternate</i>)
Shri Bajrang Power and Ispat Limited, Raipur	SHRI BANWARI LAL CHOPRA SHRI PRAVEEN KUMAR (<i>Alternate</i>)
Society of Indian Automobile Manufacturers, Delhi	SHRI P. K. BANERJEE SHRI AMIT KUMAR (<i>Alternate</i>)
Surya Roshni Limited, Delhi	SHRI N. K. SINGLA SHRI NITIN JAIN (<i>Alternate</i>)
Tata Steel Limited, Kolkata	SHRI BRAJ B. PRASAD
Tata Steel Limited, Khopoli	SHRI UDYAN TYAGI
Welspun India Limited, Mumbai	SHRI DHANANJAY BAJPEYEE SHRI PRAKASHMAL TATIA (<i>Alternate</i>)
BIS Directorate General	SHRI SANJIV MAINI, SCIENTIST 'F'/SENIOR DIRECTOR AND HEAD (METALLURGICAL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (<i>Ex-officio</i>)]

Member Secretary
SHRI SACHIN CHOUDHARY
SCIENTIST 'C'/DEPUTY DIRECTOR
(METALLURGICAL ENGINEERING), BIS

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